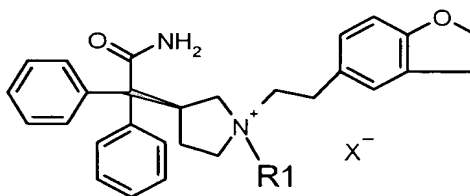


Claims

1. A quaternary ammonium compound of formula I



- 5 and any stereoisomers thereof, wherein

R₁ is selected from C₁-C₆ alkyl, -CH₂-(C₁-C₄ alkenyl), and -CH₂-(C₁-C₆ alkynyl), each of which is optionally substituted with a group selected from phenyl, C₁-C₄ alkoxy, and hydroxyl; and

X represents an anion of a pharmaceutically acceptable acid.

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2. The compound of claim 1, wherein X is selected from the group consisting of the anions of the following acids: tartaric, hydrochloric, hydrobromic, hydroiodic, sulfuric, phosphoric, nitric, citric, methanesulfonic, CH₃-(CH₂)_n-COOH where n is 0-4, HOOC-(CH₂)_n-COOH where n is 1-4, HOOC-CH=CH-COOH, and benzoic.

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3. The compound of claim 1, wherein X is selected from the group consisting of iodide, bromide, and chloride.

4. The compound of claim 1, wherein X is iodide.

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5. The compound of claim 1, wherein X is bromide.

6. The compound of claim 1, wherein X is chloride.

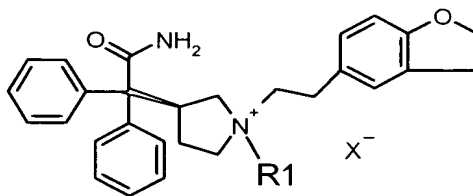
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7. The compound of claim 1, wherein R₁ is methyl.

8. A compound (3S)-3-(2-amino-2-oxo-1,1-diphenylethyl)-1-[2-(2,3-dihydro-1-benzofuran-5-yl)ethyl]-1-methylpyrrolidinium iodide.

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9. A pharmaceutical composition comprising a therapeutically effective amount of a quaternary ammonium compound of formula I



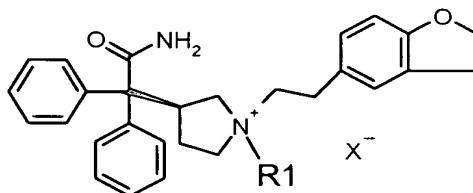
and any stereoisomers thereof, wherein

R₁ is selected from C₁-C₆ alkyl, -CH₂-(C₁-C₄ alkenyl), and -CH₂-(C₁-C₆ alkynyl), each of which is optionally substituted with a group selected from phenyl, C₁-C₄ alkoxy, and hydroxyl; and

5 X represents an anion of a pharmaceutically acceptable acid.

10. The pharmaceutical composition of claim 9, wherein the pharmaceutical composition further comprises a suitable pharmaceutical carrier.

10 11. A method of treating asthma in a mammal, comprising administering a therapeutically effective amount of a quaternary ammonium compound of formula I to a mammal in need of such a treatment, wherein the compound of formula I has the structure



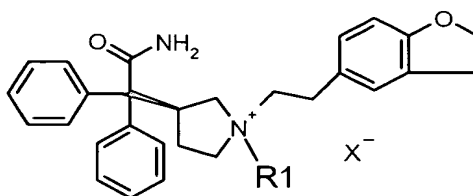
15 and any stereoisomers thereof, wherein

R₁ is selected from C₁-C₆ alkyl, -CH₂-(C₁-C₄ alkenyl), and -CH₂-(C₁-C₆ alkynyl), each of which is optionally substituted with a group selected from phenyl, C₁-C₄ alkoxy, and hydroxyl; and

X represents an anion of a pharmaceutically acceptable acid.

20 12. A method of treating chronic obstructive pulmonary disease in a mammal, comprising administering a therapeutically effective amount of a quaternary ammonium compound of formula I to a mammal in need of such a treatment, wherein the compound of formula I has the structure

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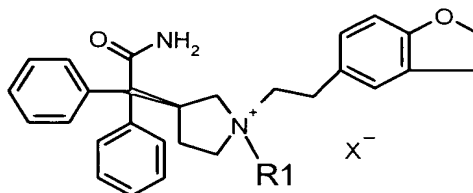


and any stereoisomers thereof, wherein

R₁ is selected from C₁-C₆ alkyl, -CH₂-(C₁-C₄ alkenyl), and -CH₂-(C₁-C₆ alkynyl), each of which is optionally substituted with a group selected from phenyl, C₁-C₄ alkoxy, and hydroxyl; and

5 X represents an anion of a pharmaceutically acceptable acid.

13. A method of treating allergic rhinitis in a mammal, comprising administering a therapeutically effective amount of a quaternary ammonium compound of formula I to a mammal in need of such a treatment, wherein the compound of formula I has the structure

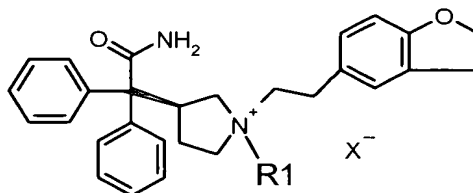


and any stereoisomers thereof, wherein

R₁ is selected from C₁-C₆ alkyl, -CH₂-(C₁-C₄ alkenyl), and -CH₂-(C₁-C₆ alkynyl), each of which is optionally substituted with a group selected from phenyl, C₁-C₄ alkoxy, and hydroxyl; and

15 X represents an anion of a pharmaceutically acceptable acid.

14. A method of treating infectious rhinitis in a mammal, comprising administering a therapeutically effective amount of a quaternary ammonium compound of formula I to a mammal in need of such a treatment, wherein the compound of formula I has the structure



and any stereoisomers thereof, wherein

R₁ is selected from C₁-C₆ alkyl, -CH₂-(C₁-C₄ alkenyl), and -CH₂-(C₁-C₆ alkynyl), each of which is optionally substituted with a group selected from phenyl, C₁-C₄ alkoxy, and hydroxyl; and

25 X represents an anion of a pharmaceutically acceptable acid.